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ABSTRACT

An experiment compared three methods of instruction in an introductory course in psychology. The first method utilized groups of three students and required that all three students meet the criterion on each unit of material in the course before being allowed to continue on to other units. This system also required that students do all remediation for other members of the groups, giving examinations, scoring examinations, and reporting examination scores to proctors. This group was compared with the standard Keller type course taught during the same quarter and a third lecture course also taught the same quarter. Performance was measured by final examination score and total points accumulated in the course for all three groups. Results indicate that the group and the Keller group did not differ on performance measures but both groups performed better than the lecture group and rated the course more favorably. (Author)

# COMPARISON OF SMALL-GROUP CONTINGENCY MANAGEMENT WITH THE PERSONALIZED SYSTEM OF INSTRUCTION AND THE LECTURE SYSTEM

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# COMPARISON OF SMALL-GROUP CONTINGENCY MANAGEMENT WITH THE PERSONALIZED SYSTEM OF INSTRUCTION AND THE LECTURE SYSTEM

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Recent developments and research on individual instruction models have mainly centered on the Keller plan (Keller, 1966) for use at the college level. Keller outlines five features of his plan which distinquishes it from other teaching procedures. A Keller course is (1) individually paced, (2) mastery oriented, (3) utilizes individual student tutoring or proctoring, (4) uses printed materials as the source of information, and (5) uses lectures and demonstrations as vehicles of motivation rather than as the primary source of information.

Although the effectiveness of the Keller system of instruction is well documented (Kulik, et., al., 1974), a technology of teaching (Skinner, 1968) need not necessarily strickly follow the Keller plan to be effective. Approaches to instruction requiring students to attend discussions, laboratories, and lectures have proven to be effective (Postelthwaite, 1964). Systems of instruction without student pacing have also been effective (Malott, 1969; Coldeway, 1974). Ferster's interview method has been used by many instructors effectively (Ferster, 1966). The key factors which appear to be important in the effectiveness of instruction across systems are first, clear specification of what is expected of the student (usually in the form of instructional objectives), second, frequent assessment of student performance and feedback for improvement, third, the chance for remediation, and fourth, a set of criteria for student performance which represents mastery of relevant material.

A system of instruction utilizing the above key factors can take many forms. The present experiment describes the design, evaluation, and comparison with other systems of instruction of a course utilizing small group pressure and group tutoring as a method of producing student motivation and academic performance. The present experimental course was compared with a typical Keller plan course and the standard lecture-discussion course. The purpose of the present experiment was to investigate a system of instruction that would increase student interaction, reduce the number of staff needed to run the course, and reduce the time needed to run the course while still producing effectiveness levels comparable to already well established Keller courses.

## METHOD

Subjects. Twenty-four students randomly chosen from 343 students enrolling in an introductory psychology course served as subjects. The subjects chosen had signed up for the same discussion section, reducing the need for changing their course schedules for participation in this experimental group. All 24 students were told in their discussion section meeting on the first day of the quarter not to attend lectures and meet in a seperate room during the regularly scheduled lecture hour.

Two control groups were also randomly chosen from the original enrollment of 343 students. Thirty-five students were selected from the lecture part of the course and thirty students were assigned to a personalized system of instruction course (Keller, 1966).

Procedure. Students assigned to the small-group system were first divided into groups of three students. Students were allowed to form their own groups if they chose, and the remaining students were randomly divided into groups of three. Each group was then assigned an undergraduate student proctor. Three proctors were used, two having three groups of students to monitor and one

having only two groups of students.

Immediately following the formation of groups, students were handed policies and procedures instructions. These instructions specified that when each member of a particular group was ready to take a unit examination, the group was required to take that examination all at the same time. Each group was responsible for the progress of all its members. If one of the members did not pass a unit examination, the rest of the members were responsible for helping that member and giving that member the next equivalent form of the unit examination, scoring that examination, and reporting the members performance to the proctor in charge of the group, until the student mastered that unit of material. therefore, the progress of the group through the units of material was dependent upon the progress of each member of a particular group. No member of a group could take the next unit examination until all the members of the group had met the criterion on the previous unit.

Each group was also responsible for scheduling their unit examinations. A contract system was used between the members of the group and the proctor. The contract specified when the next examination would be taken by the entire group. If the contract was broken by any of the group members the examination was postponed until a new group contract could be made.

The criterion for mastery of a unit examination was 90%. When a group mastered a unit examination, each member was given a form of the objectives for the next unit, and a contract was made for the next unit examination. If one or more members of the group did not master a particular unit examination, the members of the group decided when remedial examinations would be given by the members already at mastery on that unit.

When all members of a group had completed a unit examination, it would be corrected with the proctor and all the group members present. The students would report their answers to the questions verbally and discussion was

encouraged. If any members had incorrect answers the other members of the group were encouraged to help that member with the problem. When all the questions had been scored the proctor indicated to each member whether he had passed or failed that examination.

The PSI control group was put into a Keller plan course on the first day of the quarter. These students were assigned an undergraduate student proctor and also given policies and procedures instructions that described the basic Keller type course. These students were free to work individually and at their own pace through the units of material. The only restriction on pacing was that they must complete the first four units of materials by the end of the sixth week or they would be asked to withdraw from the course. These students were also told that incompletes would not be given and units not completed by the end of the quarter would reduce the number of total points they could earn.

The third group of lecture students were a part of a larger lecture section of the course taught at the same time as the small-group course and the PSI control course. Students in the lecture group attended a 50 minute lecture three days a week given by the faculty member in charge of the course. Students in this group also took two midterm examinations during the fifth and eighth weeks of the quarter. Both midterms were multiple choice examinations, with 50 questions on each examination. Students in this group received the number of correct answers as their midterm scores, a criterion for performance was not set and students could not remediate.

Procedures common to all three groups. Students in all groups used the same text (Introductory Psychology, Individual Learning Systems, 1973) and were required to read the novel I Never Promised You a Rose Garden, by Hannah Green as the last unit of material covered in the course. Students

in all groups were given objectives covering all units of material in the course. The objectives were written by the first author and tested on unit examinations and on the midterms given to the lecture group.

Students in all three goups could earn additional points by doing some or all of the following optional assignments (see table 1). First, students in any group could earn 4 points for each experiment participated in up to a maximum of 20 points. Second, students could earn 2 points for each discussion section they attended. Discussion sections were conducted by graduate assistants and designed to let students experience psychological procedures first hand. No information from the text or lectures was covered in the discussion sections. Third, students could earn additional points by successfully writing and handing in two abstracts covering articles they had read (5 points per abstract) and also by writing and handing in an experimental proposal by the ninth week of the quarter (10 points maximum). Written assignments were graded and returned by the graduate assistants. Rewrites were allowed if students handed in the assignments by the deadline dates. Finally, all students took a comprehensive final examination during the eleventh week of the quarter. The final examination was 75 questions, multiple-choice, and covered all the units plus the novel. No questions from the unit examinations or midterm examinations were used on the final examination.

Grading was dependent upon a point system (see table 1). Table 1 shows the grade scale that was used for all three groups of students.

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Insert Table 1 about here

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The small-group system and the PSI group could earn a maximum of 100 points for completion of all unit examinations at the specified mastery criterion. The midterm examinations taken by the lecture group were worth 50 points each.

## RESULTS

The data were analyzed using a planned comparison model. This analysis compared the performance of the small-group system with the PSI group and the combined performances of the small-group system plus the PSI group with the lecture group.

The comparison of the small-group system with the PSI group found to be non-significant ($F = 1.27$, 1, 86 df; $p > .45$) using the number of points earned on the final examination as the dependent variable. The mean final examination score for the small-group system was 63.54 in comparison to a mean score of 62.93 for the PSI group. The same comparison was also made between the small-group system and the PSI group using total points accumulated in the course as the dependent variable. This difference was also found to be non-significant ($F = 1.94$, 1, 86 df; $p > .25$). The mean total points accumulated for the small-group system were 202.66 and the points accumulated for the PSI group were 195.65.

The comparison of the combined performance of the small-group system and the PSI group with the lecture group, using the final examination score as the dependent variable, indicated a significant difference ($F = 5.25$, 1, 86 df; $p < .05$). This difference indicated that the combined performances of the small-group system and the PSI group on the final examination was higher than the performance of the lecture group on the final examination (mean final examination for small-group and PSI = 63.235; mean final examination score for lecture = 56.552).

The comparison of the combined performance of the small-group system and the PSI group with the lecture group using the total points accumulated in the course as the dependent variable indicated a significant difference ($F = 11.34$, 1, 86 df; $p < .01$). Both the small-group system and the PSI group accumulated significantly more points in the course than did the lecture group (mean points accumulated for groups small-group and PSI = 198.84; mean points accumulated for lecture = 178.85).

The grade distributions for all three groups are shown in figure 1. No student in the small-group system received lower than a C grade and there were no students withdrawing from this group. The PSI group showed a similar grade distribution as the small-groups system. However, one student in this group did receive a 'D' grade and seven students withdrew from the PSI group before the end of the sixth week of the quarter. All seven of the students withdrawing from the PSI group were behind the pace of the majority of the PSI students and were asked to drop the course for that reason. The grade distribution for the lecture group was considerably different from the small-groups and PSI distributions. Less than 50% of the students received 'A' grades with four students receiving 'D' grades and one student receiving a failing mark in the course. Only 3 students withdrew from the course. All three students withdrew before the end of the sixth week of the quarter without instructions from the course staff to do so.

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Insert Figure 1 about here

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Students in all three groups were asked to fill out the Illinois Course Evaluation questionnaire (Aleamoni, 1972) during the eleventh week of the quarter. The mean rating and decile ranking of each subscore category on the Illinois Course Evaluation questionnaire are presented in figure 2.

A comparison of all three groups mean averages with mean averages from introductory courses taught in the United States was computed. The small-groups system and PSI group both rated the course higher than the USA average rating ($\bar{X}_{sgs} = 3.14$; $\bar{X}_{USA} = 2.88$; $t = 3.11$, 10 df; $p$ .01: $\bar{X}_{PSI} = 3.09$; $\bar{X}_{USA} = 2.88$; $t = 2.89$, 10 df; $p < .05$). The lecture group and USA ratings were not significantly different.

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Insert Figure 2 about here

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Written comments by the students on the Norr-Crittenden teacher evaluation questionnaire were also obtained during the eleventh week of the quarter. Ninety percent of the small-group system students wrote in comments. Most of the comments were favorable and centered on the students high ratings of objectives, frequent examinations, and a chance to work with other students. Some of the students commented that the group pressure was sometimes aversive, especially when they were busy with other courses.

Eighty-six percent of the PSI students wrote in comments on the Norr-Crittenden teacher evaluation form. The majority of these comments were also favorable and centered around the students high rating of the objectives, frequent testing procedures, individual pacing, and content of the course in general. Some students complained about a lack of student-teacher interaction and the fact that there was not much chance for group discussions on course material.

Sixty-five percent of the lecture students wrote in comments on the Norr-Crittenden teacher evaluation form. The majority of these comments were not favorable to the course procedure. Students complained about having to attend lectures, about the lack of feedback on examinations, and about the

high level criterion needed to reach an 'A' grade. However, students in this group did comment favorably on the course content and discussion sections.

## DISCUSSION

The results of the present experiment clearly indicate that the course utilizing small group contingencies and group contracting performed equally as well as a standard Keller type course and significantly better than a traditional lecture style course. Although the total points and therefore grade distributions for the small-groups and PSI courses are higher than those of the lecture course, this variable in partially confounded because of the greater availability of points for the small-groups and PSI groups due to remediation on unit examinations. Lecture students could not remediate mid-term examinations and were forced to receive only the number of points they earned by taking each midterm the first time.

However, the analysis of the final examination scores clearly shows that both the small-groups system and the PSI group did retain considerably more of the course material than did the standard lecture group. Because the questions included on the final examination had not previously appeared on midterm examinations or unit examinations, it appears that the final examination scores do represent the amount of material retained by students. However, the level of learning attained by students is not indicated by their final examination score or total points accumulated. A post-hoc analysis of the final examination questions indicates that approximately 85% could be considered to be measuring memory level skills while only 15% could be considered to be measuring higher cognitive (conceptual) skills (Anderson, 1973; Markle and Tiemann, 1969). Previous research has shown the error rates on conceptual level questions to be higher than on memory level questions regardless of the level of motivation or contingencies put on student's behavior (Coldeway, 1974).

Therefore, the data obtained from the present experiment cannot be interpreted to indicate that the small-groups system or PSI groups would have performed better than the lecture group if the majority of the objectives were conceptual in nature (Gagne, 1974).

The responses by students on the Illinois Course Evaluation questionnaire clearly show that the small-groups systems students rated the course highly in comparison to the United States averages for introductory courses and in comparision to the lecture group in the present experiment. The high ratings also suggest that the students did not find the peer pressure or group contingencies strongly aversive. However, comments written by the small-groups systems students did indicate some problems with the group contingencies when particular members of a group had conflicts with other courses. In addition, two of the groups had to be reorganized early in the quarter when members of these groups complained to their proctor that not all the group members wished to work at the same pace through the course materials. Both groups were allowed to reorganize to provide for more compatibility among the group members.

The zero level withdrawal rate in the small-groups system is especially encouraging given previous reports of PSI courses with up to 15% withdrawal rates (Kulik, et., al., 1974). The high course evaluations and added peer pressure in this group can be hypothesized for keeping students enrolled in the course. However, the high ratings of the subject matter and course content by all three groups suggests that this factor aided in keeping the withdrawal rate low in all three groups.

One of the primary reasons for including the small groups variable in the experimental group was to determine if that variable would increase student interaction and discussion. The observation of proctors working

with the experimental group indicates that students in this group were often observed discussing the course materials outside the testing area. The proctors also report that students in the experimental group would often begin discussions with them about material covered in the course or other topics in psychology related to the course content. Observations of the other two groups (PSI and Lecture) by proctors and the instructor did not indicate that students in these groups spent much time interacting with each other or in discussions of course material.

Another variable relevant in this experiment was the economy of each particular system of instruction. The experimental procedure required fewer proctors per student and the contracting for unit examinations reduced the time proctors spent waiting for students to complete examinations. Proctors in the small-groups system could schedule examinations, leaving adequate time for correcting the examinations and discussion of important points. Students in the small-groups system also profited by the contracting system. Each student in this group was always assured that a proctor would be available for correcting the examination whenever the group was completed with the examination. Students did not have long waiting periods as was often the case in the standard PSI group.

Requiring that members of groups be responsible for remedial examinations also produced some important effects. Students already passing a particular unit examination would assist a fellow group member who did not pass in understanding the material more completely for the next form of the examination. The students who had already passed the unit examination would also give the remedial examinations, freeing proctors for discussions and record keeping tasks.

Although the overall effectiveness of the experimental course was good in the present experiment, some problems with this systemof instruction could develop if this system of instruction was used with a larger number of students. The potential for cheating is increased when students are required to examine each other, especially when the contingencies specify that the group cannot go on until all the members have met the criterion. Furthermore, the rearrangement of groups on a large scale could cause problems not encountered in the present study. An excess number of students may wish to go fast through the materials leaving only few students wishing to proceed at a slower pace. The formation of groups of compatible students may be more difficult and maybe even impossible. It is doubtful that groups larger than three would be as efficient although groups of two could work if necessary.

It is important to note that the present experiment used competency based evaluation rather than normative based evaluation. A system utilizing groups of students who were graded on "the curve" could cause problems and conflicts between students. It is doubtful that such a system would produce increased student interaction or increased student performance. However, the interaction of several variables involved in the small groups method needs to be further investigated before any firm conclusions can be made about the overall efficacy of such a system.

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FOOTNOTES

[1]Now at Courseware, Inc., P.O. Box 811, Provo, Utah 84601.

TABLE 1

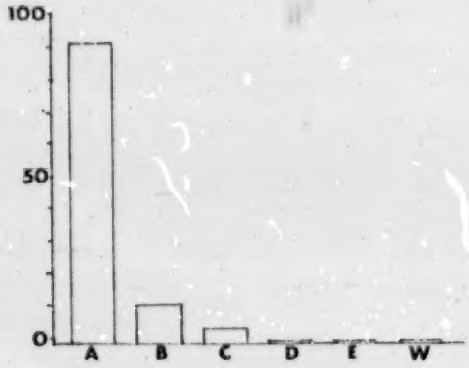
Points Possible for Activities

| Groups | Unit Exams | Midterms | Final | Written Abstracts | Written Proposals | Discussion Attendance | Exper. Participation | Total |
|---|---|---|---|---|---|---|---|---|
| Small-group system | 100 | none | 75 | 5 each 10 | 10 | 2 each 20 | 4 each 20 | 235 |
| PSI system | 100 | none | 75 | 5 each 10 | 10 | 2 each 20 | 4 each 20 | 235 |
| Lecture system | none | 100 | 75 | 5 each 10 | 10 | 2 each 20 | 4 each 20 | 235 |

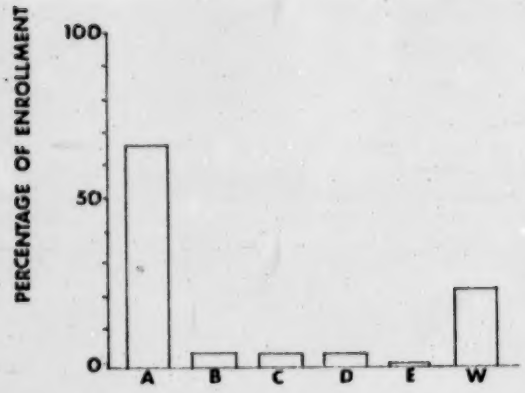
Final Grades

| | | |
|---|---|---|
| above 195 points | A | 83% |
| 170-194 | B | 72% |
| 150-169 | C | 64% |
| 125-149 | D | 53% |
| below 125 | E | |

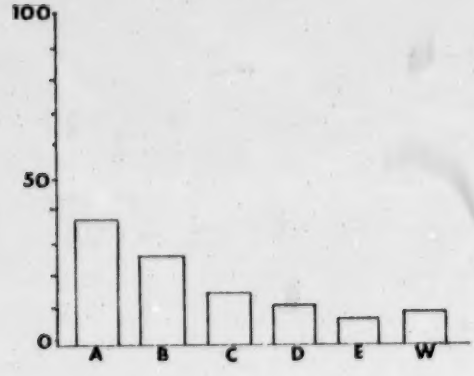
SMALL GROUP SYSTEM N=24

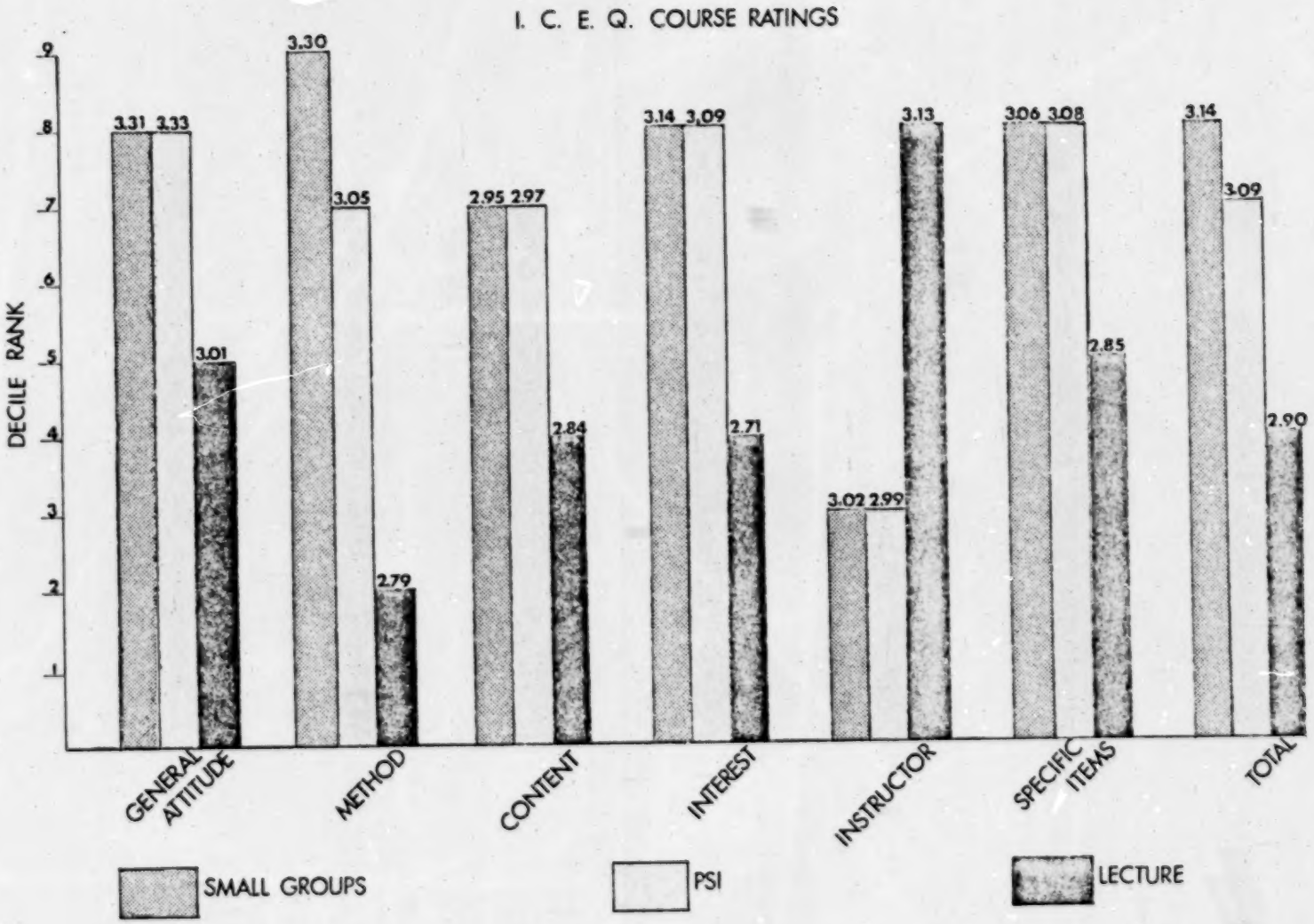



PSI SYSTEM N=30




LECTURE SYSTEM N=35




I. C. E. Q. COURSE RATINGS
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GENERAL ATTITUDE
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INSTRUCTOR
SPECIFIC ITEMS
TOTAL
SMALL GROUPS
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